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February 1977

TRANSLATIONS ON EASTERN EUROPE

SCIENTIFIC AFFAIRS

No. 535

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CONTENTS PAGE

NEUROBIONICS DISCUSSED

Sofia PRIRODA in Bulgarian No 4, 1976 pp 41-44

[Article by Evgeni P. Dyukendzhiev: "Neurobionics"]

[Text] Neurobionics is an area of specialization in bionics which uses the findings of neurophysiological, psychological and mnemological research on animals and man to design technical equipment. Chronologically, the development of neurobionics began with the study of neurons. At present more than 100 bionic analogs have been created, reflecting to a certain degree the properties of their biological prototypes. In scientific research two approaches have been differentiated for the simulation of neurons. In the first, models are created which, where possible, completely reproduce the neurons' physiological processes and functional peculiarities. In the second, the principal objective is to convert histological data into analyses of functions, into a mathematical description of the processes taking place in neurons and neuron networks (the space-time complex of neurons and the connections between them).

Morphological studies show that there is no single-type schematic representation of the junction between neurons, and physiological experiments indicate that there are probability paths for the flow of pulses (Rosenblatt, 1964; Davidson, 1965; et al.). Under these conditions it is not the state of every element individually that plays a significant role, but the character of the whole spatiotemporal "ensemble" of neurons taking part in the effectuation of a nervous act. Consequently, the especially high reliability in brain functioning is due to probabilistic-statistical organization, i.e., high reliability in the functioning of systems is achieved only if there is minimal determinacy of interaction between elements.

Optimal organization of living systems is the result of a long evolutionary process under conditions of a highly variable environment. Environmental variations have had a twofold influence on organisms. The necessity of adaptation dictated the creation of probability functions, which gave rise to a continuous increase in the complexity of structures.

On the other hand, the increase in the complexity of systems is due to an inevitable increase in the possibilities of errors and the failure of elements, which process by its nature is of a statistical character. That is why the nervous system has developed by way of an increase in dynamism and reliability due to the growth of the stochastic interactions of neurons. Numerous experimental and clinical data show that partial injuries of cortical divisions (for example, of the visual analyzer) may have practically no effect on the functions performed. Only with the loss of more than 40 percent of the mass of gray matter do significant impairments ensue (A. B. Kogan, 1967).

The complexity of the nervous system as a whole and of its structural elements leads to certain difficulties in the creation of mathematical and bionic analogs. That is why neurobionics has embarked upon the path of evolution -- from the simple to the complex. To begin with, analogs of structural elements were created, and functional ensembles were undertaken later on. Bionic nerve-cell models make possible a rapid check of the embedded ideas as well as their practical use. As regards the purpose of these models, the following classification can be made: a) reproduction of the probabilistic characteristics of neuron-network functioning; and b) reproduction of the determined functional characteristics of the neuron.

Several types of nerve-cell models have been created at present according to principle of operation. The ferristor neuron model (Rosenblum, 1962) is made on the basis of transistors and ferrite core (with a rectangular hysteresisograph). It makes possible modeling of the "phase-change" process. Input signals may be excitatory and inhibitory, the kind of signal depending on the direction of the current in the input winding.

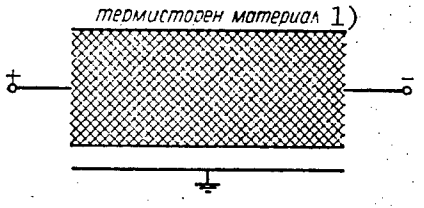


Figure 1. Design of neuristor

Key: 1. Thermistor material

In 1960 Crane laid the foundations of neuristor models. Neuristor connections have properties similar to nerve fibers -- attenuationless signal production and recovery of line qualities after signal conduction (Figure 1). Electric current passes through the thin film of the thermistor material. An ordinary conductor serves as one pole of the capacitor, and a thermistor emulsion as the other. If the temperature of the thermistor

material rises at some point of the line, resistance drops at this point, which triggers a local discharge. For their part, the discharge currents raise the temperature of the adjacent portions, and the process is repeated. The driving pulse propagates thus along the length of the line uniformly and without attenuation. A zone of refractoriness (insensitivity) is left behind the excitation front since the discharged portions can be reexcited after they accumulate energy. Comprehensive use is made of the methods of cryogenic engineering, the properties of gas discharges, special chemical reactions and semiconductors in order to design neuristors. Thus, for example, in 1965 a description was published of a tunnel diode representing a line one centimeter long and 100 microns wide. The properties of a neuristor line are identical over the entire length, with pulses having a duration of about 0.1 millisecond and propagating at a velocity of 100 kilometers per second.

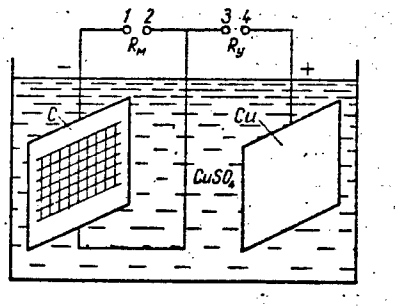
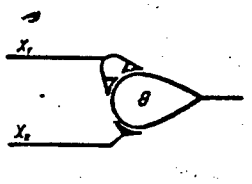


Figure 2. Line diagram of mnemistor

A third type of neuron model is the variable resistance, the value of which can be made stationary by means of a control current (B. Widrow, 1962). This bionic model is called the "mnemistor" (Figure 2). Carbon (cathode) and copper (anode) electrodes are dipped in an aqueous solution of copper sulfate (electrolyte). The control voltage is applied to contacts 3, 4. If the sign of this voltage is such that the anode potential is positive with respect to the cathode potential, copper will be deposited on the cathode as electrolysis takes place. With an increase in the deposition of copper, the input resistance of the mnemistor $R_{m1.1}$ declines. In the event of a change in the sign of the control voltage, the layer of copper varies its thickness. In this wise the process is reversible. The difference between initial and terminal resistance can be as much as 10,000-fold.

One of the avenues in the development of neuron-network modeling is the creation of plastic neuron models (Sochivko, 1963). By neuron plasticity (of the formal type) is meant the change of the neuron's logical properties according to the history of its activity. The property of plasticity

is realized by varying the threshold actuating quantity or by varying the weight of the inputs, i.e., the coefficients reflecting in varying degree the influence of individual inputs on the resultant state of the model (Figure 3).



x_1	x_2	y, при θ = -1	0	1	2	3
0	0	1	1	0	0	0
0	1	1	0	0	0	0
1	0	1	1	1	1	0
1	1	1	1	1	0	0

1)

Figure 3. Plastic neuron and logical properties (according to V. Sovichko)

Key: 1. given

L. Waller in 1964 created an original bionic device simulating the activity of live neuron networks. In addition to self-learning capabilities, it possessed the only decision-making ability of its kind. The bulk of the device is a mixture of iron spherules and gold particles immersed in an acid medium. Every signal passing through the system makes the gold particles create connections ("dendrites") between the iron spherules ("neurons"), the parameters of the connection corresponding to the parameters of the signal. The machine "learns" by the trial-and-error method. In case of an error an electrical signal pulse destroys the connection that has been formed. The density of elements in the system is about 3.6 million per cubic centimeter.

The basic neurobionic problem is information storage in the brain and recognition and reproduction of past emotional processes. The existence of memory makes possible the accumulation of experience, its preservation and utilization. There is a special science of memory and thinking -- mnemology. Accumulated experimental data permit differentiation of two kinds of memory. It is thought that short-term memory is based on the circulation of signals in neural feedback circuits. The basis of long-term memory is long-term physicochemical and morphological changes. In mammals, short-term memory is "fixed" and converted into long-term memory in about an hour. This conclusion is based on the fact that severe trauma -- a violent blow on the head, electrical shock etc. -- can partially or completely impair the memory of events that happened less than an hour before but not affect at all the memory of events in the distant past (Beritashvili, 1974).

There are at present three hypotheses regarding the form in which storage takes place (S. Deutsch, 1970). The anatomical hypothesis assumes that

in two excited neurons collateral branchings directed towards each other appear, between which permanent connections are formed in about an hour. According to the chemical hypothesis, synapses are in abundance so that in some small area every neuron is actually in contact with all the other neurons. Two excited neurons put the synapse connecting them into a state of excitement through a mediator. This change takes place in about an hour. The molecular hypothesis assumes that an engram (memory trace) is stored in molecules of ribonucleic acid. Adenosine triphosphate is used as energy source (Hyden, 1960).

Recently a new idea has been discussed -- the part played by the neuroglia in the effectuation of the memory mechanism. An interesting paradox arises in experiments: neurons are high-speed elements; their action is measured in thousandths of a second, but there are altogether different time scales in the memory (from several seconds to several hours). Does it follow that the slow phenomena (memory phenomena) are due to the neuroglia? Galambos (1961) gave a realistic explanation of ion exchange in the neuron-neuroglia circuit. This explains why when substances that disturb the neuroglia functions are introduced into the brain a reaction of the entire organism, changing its total state, is induced.

The material carrier of the long-term memory results from the interaction of complex biochemical compounds, the content of which in the neuroglia cells regulates the speed at which information propagates. The change of short-term memory into long-term memory takes place because of the appearance of these compounds under the influence of potassium ion fluxes (S. Deutsch, 1970) and is evidenced by the presence of nerve impulses due to a specific stimulation. What is not explained is why, in contrast to neurons, which from the very birth of the organism do not divide and do not change throughout its entire life, the neuroglia is constantly renewed. In what way is this linked with the memory (L. Gerardain, 1971)? Does this process of renewal and division perhaps underlie man's capacity to generalize everything he knows?

Available experimental data give reason to believe that biological systems process information using heuristic-programming methods (K. Eshbi [transliterated from the Bulgarian; possibly C. or K. Ashby], 1966). With this approach, the problem divides into several stages, at each of which an estimate of the situation is made and improbable avenues discarded. This process is called "pruning the decision tree." More specifically, the heuristic-modeling process consists of the following states: a) study of the laws whereby the modeled system functions, by means of the "black-gox" method; b) translation of the obtained information into clear algorithms permitting program realization; c) construction of hierarchical programs; d) comparison of the behavior of the model and man in analogous situations; e) corrections on the model according to the results of comparison until the necessary results are obtained.

Present-day computer equipment has very limited capabilities as regards bits of information per gram weight per second in comparison with the human brain (Bremermann, 1973). This means that new ways of programming and technical realization on the computer must be sought. Possibilities are afforded through development, by analogy with living organisms, of microcomponent models of molecular size. For the purpose research is under way on semiconductor microstructures representing two- and three-dimensional circuits of conducting elements in an insulating medium. In carrying out the reaction whereby copper fibers are deposited when an electric current is passed through a solution of iron sulfate, G. Pask (1962) obtained a highly branched system of fibers in a vessel with a great number of electrodes. Information in the form of electric signals comes into the system of iron fibers through the electrodes. Through special decoding electrodes, likewise inserted in the system, stored information is obtained. Pask has developed a number of methods making possible the realization of a system which is self-organizing to achieve some goal.

Development of the theory of finite automata in recent years has significantly advanced the possibilities of designing learning machines. The Meltar Company (United States) has created adaptive pattern-recognition machines based on "artron" -- an artificial neuron of the probability type. A fundamental problem is the transition from pattern recognition to situation recognition. An electronic computer of a new type, the "Vadalin," has been created (1967); it is designed on the basis of analog memory elements -- mnemistors.

The discovery of hierarchical methods and means for solving control problems in biological systems and their translation into technical language will yield promising results for the development of a number of areas of technology. In the USSR, prostheses for the upper extremities controlled by the patient's biocurrents have been in practical use for years. A. E. Kobrinskiy and staff have developed a bioprosthesis controlled by the operator's mental desire. But these problems are more the subject matter or robotics (a branch of bionics modeling man as a whole) than of neurobionics. The facts indicate that for the present no universal technical optimality criteria have been created for biosystems, nor has the structure or degree of autonomy of individual elements been determined, nor the possibilities of changes in the process of functioning according to the ambient environment. As complex technical systems are created, networks of protective devices operating in a coordinated manner and utilizing biological principals must be organized. Bionic methods and hardware are needed in order to use information to control the material and energy characteristics of technological processes.

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CSO: 2202

BULGARIAN SCIENTIFIC INSTRUMENTS USED IN SPACE RESEARCH

Sofia VECHERNI NOVINI in Bulgarian 8 Jan 77 p 4

[Article by Professor Doctor Kiril Serafimov, corresponding member, International Academy of Astronomics, Paris: "Bulgarian Instruments Are Studying the Plasmosphere"]

[Text] For the past several years a new concept of space around the earth has reflected the great achievements in the study of this environment, achieved in the era of satellites. The term "plasmosphere," suggested by the World Space Research Committee (COSPAR) characterizes the part of the space surrounding earth consisting mainly of protons. Since the boundaries of this plasmosphere are not clearly demarcated, it has been accepted to consider as its beginning the altitude at which proton concentration equals the concentration of oxygen atomic ions which increases closer to earth. At higher altitudes protons predominate and the area is called plasmosphere or protonosphere; at lower altitudes the influence of oxygen ions characterizing the ionosphere increases. Therefore, the area where protons and oxygen-ion concentrations are equalized is a typical transitional level where interesting phenomena occur of important morphological significance in terms of the full study of the complex processes occurring in outer space.

Together with a group of American scientists I heard in Dallas, at Texas University, a report delivered by Candidate of Physical Sciences Iv. Kutiev, from the Bulgarian Academy of Sciences Central Outer Space Research Laboratory, on changes in the lower limit of the plasmosphere, based on data of Bulgarian-Soviet studies made through satellites and rockets of the Interkosmos series. I was pleased with the general attention paid to the original and interesting results. At the same time, I was considering, yet once again, the tremendous opportunities which were given to us by Soviet science and technology enabling us to carry out such delicate and difficult research, for even the simple enumeration of the apogees of so-far launched ionospheric satellites of the Interkosmos series, containing Soviet-Bulgarian instruments on board, would show the great abundance of valuable data obtained for the study of the lower limit of the plasmosphere and related changes in phenomena and processes. The environment at an altitude ranging from 600 to about 1,800 km was thoroughly measured with the Interkosmos-II satellite, with a 1,240 km apogee, through the eighth satellite from the same series (680 km apogee) and the twelfth (718 km apogee) to the fourteenth (which reached a durable maximal altitude of 1,500 km). According to

present-day data the daytime lower limit of the plasmosphere varies from 1,800 to some 3,000 km, depending on the geomagnetic position, season, and cycle of solar activities; during the night it drops to about 600 km.

Bulgarian-Soviet trapping ions on the four satellites mentioned, and on the Vertikal-IV rocket (which reached an altitude of 1,540 km) brought a number of new and so far unknown data on the variations of this transitional border level. Our measurements concerned the drastic drop of the lower edge of the plasmosphere to about 600 km immediately after sunset. Immediately afterwards, however, the limit begins to rise so that, by the middle of the night, at medium geographic latitudes it has reached an altitude of about 700-750 km. Even though no complete proof has been obtained, it may be considered that after 1-2 am the altitude declines again, reaching its lowest level before sunset. Sunset triggers a drastic elevation of the lower plasmospheric limit to several thousand kilometers above the earth.

The interesting data obtained through Bulgarian studies enable us to sum up the basic morphological laws governing the lower part of the plasmosphere. On the other hand they constitute excellent experimental data for analyzing the complex processes of transportation, loading, reloading, and neutralizing of energy transformations of particles in immediate outer space.

We have also undertaken the study of some specific plasmospheric areas influencing the entire earth, such as the so-called Brazilian Magnetic Anomaly. The particular condition of this kind of "entrance" to outer space surrounding the earth for powerful proton and electron flows determines the great interest displayed in determining precisely the conditions in this area which could affect the high atmosphere over the entire earth.

Direct studies with instruments mounted on satellites and rockets are supplemented by observations from the ground of some phenomena in the plasmosphere and magnetosphere such as, for example, the recordings of so-called radio noises conducted by the Bulgarian Academy of Sciences Geophysics Institute. The study of the characteristic radio disturbances enable us to obtain relatively easily information on electron concentrations in some areas of the plasmosphere. Comprehensive measurements of natural radio radiations in the plasmosphere, of their registration as a "characteristic" of earth, and of the local ion and electron concentrations and temperatures, conducted jointly by Soviet, Czechoslovak, and Bulgarian scientific institutes from the Interkosmos-14 satellite and from ground observatories created conditions for the full study of the plasmosphere, for standardizing earth observations and achieving substantial progress in this scientific field.

5003
CSO: 2202

NEW NUCLEAR INSTRUMENTS DESCRIBED

Sofia ZEMEDELSKO ZNAME in Bulgarian 13 Jan 77 pp 1, 3

[Article by Academician Khr. Yh. Khristov, director of the IYaIYaE [Institute for Nuclear Research and Nuclear Power Industry] of the Bulgarian Academy of Sciences and Senior Scientific Associate N. Buchvarov, head of the Sector for Radioisotope Methods and Instruments: "Nuclear Instruments for the Needs of the Homeland"]

[Text] Guided by the Party's directive of linking science with our national economy, the Institute for Nuclear Research and Nuclear Power Industry (IYaIYaE) of the Bulgarian Academy of Sciences is directing its efforts primarily toward the development of basic and applied research. Naturally, everything in science is interrelated and there are no sharp boundaries: experimentation, theory, and practice are reciprocally supplementary. Nevertheless, even though schematically, one could say that in our institute applied developments follow two lines: nuclear power industry and nuclear instrument making.

Nuclear instruments represent the senses and the brain of nuclear power plants: without them no controlled chain reaction in the splitting of uranium would be possible. They are the exceptionally sensitive organs with whose help we discover and measure even entirely insignificant levels of radioactivity which could appear in the soil, water, plants, and foodstuffs. They are the irreplaceable assistants of man enabling him rapidly to analyze the composition of matter, determine the moisture content of various materials, measure the thickness of paper, textiles, and rolled metal, and so on.

It turned out that the corona counters which were designed earlier to resolve some problems related to the protection of our research reactor could be used for designing a number of useful instruments such as, for example, neutron moisture counters for the soil and for a variety of construction materials. A group of associates headed by engineer N. Buchvarov undertook to design them. The initial prototypes were tested in measuring the moisture of sand used in concrete manufacturing. They make it possible to automate the dosing of concrete components, thus leading to considerable savings. On the request of the Main Administration of Roads and Khidrostroy another type of neutron moisture counter was developed, combined with a gamma densitometer, used for controlling the packing of dirt enbankments in the building of roads, dams, and others.

In recent years an original neutron moisture counter was developed to control soil moisture reserves. It will be used in irrigation work. On the basis of this development the Special Electronics Institute, Pleven branch, is developing an industrial model with a view to its production this year by the Pleven Nuclear Instruments Plant.

Other research deals with controlling the environment for radioactive pollution and dosimetric control of the personnel working in the area of ionizing radiation. A group of IYaIYaE associates, headed by Senior Scientific Associate I. Mischev, developed an integrating thermoluminescent dosimeter based on domestic fluorites.

A third group of institute associates, headed by Senior Scientific Associate Khr. Kamburov and Senior Scientific Associate Iv. Vankov, developed a number of radiometric instruments, some of which have long been in use. Let us note among them an instrument for measuring the aerosol radioactivity of the air and an instrument for measuring the radioactive pollution of water and other transparent liquids. In 1975 an original design for an automatic radiometer for low beta activity in solid substances was completed. Such instruments are used in nuclear electric power plants to control radioactive purity, by the hygiene services of the Ministry of Public Health, which watch over the quality of foodstuffs, in mining and geological surveys, and others.

We must also note the high parameter gamma-angle correlation spectrometer created by Scientific Associate G. Tumbev and Kh. Myuning. Suitably connected, it could be used in a number of nuclear physics experiments. One-of-a-kind super-miniaturized detector preamplifiers, made of cadmium telluride were also designed on contract with the International Atomic Energy Agency. They are used for controlling the combustion process in nuclear reactors.

A group of associates developed a new beta relector. This is an instrument with the help of which the precentile content of a number of heavy or medium-heavy elements could be established in a few minutes on the basis of the density of the flow of a reflected data radiation sample. The first such instruments have already been used by Barit in Stara Zagora, Gorubso in Madan, and Niproruda in Sofia. They are being successfully used by the International Atomic Energy Agency in inspection control.

Very recently the operational personnel of the reactor, headed by Engineer Iv. Pandev, suggested and developed, through its own efforts, the most powerful Bulgarian gamma radiation system charged with the cobalt-60 radioactive isotope. It is already being used in the sterilization of instruments and other materials, the preservation of living tissue, the development of new materials, the stimulation of seeds, and others.

New problems were developed with the completion of the Kozloduy Atomic Electric Power Plant. One of them was the development of an instrument for precise control of boric acid concentration in the water of the first circulation cycle, through which the chain reaction in the reactor is controlled. This task was successfully accomplished by personnel headed by Professor V. Khristov and for over one year the instrument has been in operation at the plant.

Plutonium-239 accumulates in the active area of nuclear reactors. In order to control this process, we were entrusted, by virtue of a contract with the International Atomic Energy Agency, to develop proper methods and instruments. The group headed by Professor V. Khristov developed a special portable instrument for the non-destructive measurement of the amount of plutonium accumulated in heat releasing elements in the course of their operation.

Many other examples of no less useful development could be cited. However, the ones already mentioned give us a certain idea of the activities of the institute in this direction.

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FIELD-PROTECTION BELTS ADVOCATED FOLLOWING A SERIOUS DUST STORM

Sofia KOOPERATIVNO SELO in Bulgarian 13 Jan 77 p 2

[Article by Engineer Dimitur Gavrilov, director, Balchik Forrest Farm: "Are Field-Protective Belts An Obsolete Fashion?"]

[Text] On 2 March 1976, toward noon, the horizon over Dobrudzha darkened. The wind rose and began carrying to the sea huge quantities of humus. Soon it became so dark that cars had to turn their lights on while people were seeking shelter from the penetrating dust.

No such dust storm had occurred for quite some time. This calamity became the reason for the loss of thousands of tons of fertile soil and for turning, yet once again, our eyes to the somewhat recently forgotten field-protective belts. Observations indicated that the soil had remained well protected in an area of up to 200 meters from the belts.

It would be hardly necessary to repeat the long proven positive aspects of field-protective belts, particularly in big steppe plains. It was precisely this that was the reason for a special decree passed in 1951 on the building of a network of field-protective belts in Dobrudzha. In some 10 years about 85,000 decares of field-protective belts were created in Tolbukhin Okrug alone. Considerable funds and efforts were invested in a noble project.

Today field-protective belts are synonymous with Dobrudzha. The idea of them is associated not only with a wonderful green decoration of endless fertile space, but with so much desired coolness, freshness, and life. They tamed the wind and became a paradise for game. Understanding such unquestionable benefits, it hurts to see that here and there, deliberately or not, occasionally this national wealth is being encroached upon.

Some errors were made as well, mostly in the choice of tree or bush species, due to the automatic use of foreign experience in the building of field-protective belts. This required the elimination of some field-protective belts planted in unsuccessful bushes and tree species such as mahaleb cherry, false indigo, and chittamwood. This was a correct and timely measure. From 1961 to 1966, on the initiative of the Tolbukhin

Okrug People's Council, and with the cooperation of the forest farms, selective farming of field protective-belts tooks place, aimed at giving more growing space to durable timber species and develop the proper wind blowing structure of the belts. The measure was successfully carried out with few exceptions. Again during that period, following the selective felling, the belts were plowed and grazing was forbidden. All this contributed to the faster growth and strengthening of the plants. Today in many areas there are beautiful belts of honey, oak, locust, and other trees.

The field-protective belts require steady and competent care. Carried away by the implementation of major agricultural tasks, and lacking specialists, the agroindustrial complexes are unable to pay the necessary attention to field-protective belts. Furthermore, matters have gone so far that as modern agricultural equipment is introduced, hastily some field-protective belts are eliminated in order to achieve bigger land areas convenient for cultivation. Nevertheless, we should ask ourselves who served whom and who obeyed whom--technology-man or vice versa?

A serious omission in terms of field-protective belts is their unsatisfactory protection. Several years ago the forest farms were assigned this task. This was eliminated. Yet, the agroindustrial complexes are unable to develop effective measures to eliminate, for example, illegal cutting by unconscientious citizens. Today we see in many areas, like ugly wounds, the consequences of such actions. Many belts are also partially burned out for the necessary protective strips around them, prior to setting fire to stubble, are not plowed up. Thus, from cutting, singeing, and burning, the field-protective belts degenerate and break down as a result of which they are unable to play their protective role. It is not the purpose of this article to give specific examples. They are known and may be found on the territory of any agroindustrial complex.

Another striking at first aspect is the poor condition of field-protective belts. Some have been cut out with the stump left, thus unjustifiably wasting the area. In others the main timber species is either lacking or must be planted with a view to ecological requirements. They are belts with unsuitable types of poplar for dry valley areas. They are already becoming top-dry and keeping them there is pointless. There also are a number of belts consisting of different white elm types. We know that the white elm suffers extensively from the Dutch Elm Disease, as a result of which such belts are unpromising. Most of them have even dried out in varying degrees. We should also think of the locust tree belts which are entering their mature felling age and will begin to dry rather than grow if left standing.

I believe that the following is imperative:

stock must be taken of existing field-protective belts; unsuitable and unpromising ones should be removed and suitable species planted instead in order not to waste the area. To this effect it is necessary to procure as fast as possible T-100 tractors for stump pulling and crossing.

On the basis of the practical experience of the Wheat and Sunflower Institute near Gen. Toshevo and the forest farm in the area, an efficient field-protective belt program should be elaborated and implemented as of 1977 with a view to reorganizing the rejected belts. Timber species extensively tried in terms of local conditions should be included, such as red oak, honey (thorn-free type), and dry valley ash, oak, and linden trees, with a system which would make machine cultivation possible.

Care for the belts must continue above all through selective cutting and plowing between the trees.

The protection of such belts must be drastically improved with a view to blocking all encroachments on them.

Carefully watching over the conditions of field-protective belts, the Okrug management has suggested to the Ministry of Agriculture and Food Industry to transfer the belts, for management and care purposes, to the forest farms. This is being welcomed by us, foresters working in Dobrudzha, for thus the belts may be preserved and improved so that future generations as well may benefit from them.

5003
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DEVELOPMENT IN WHEAT VARIETIES REVIEWED

Sofia RABOTNICHESKO DELO in Bulgarian 13 Jan 77 p 2

[Article by Academician Pavel Popov and Dimitur Dimitrov, senior scientific associate, doctor of agricultural sciences: "Great Successes and Even Greater Obligations"]

[Text] In recent years Bulgarian wheat selection has achieved successes placing it in one of the leading positions in Europe. At present nine of its achievements have been zoned and disseminated or else are being currently introduced. In 1976 60.1 percent of the country's wheat areas were planted in domestic selection strains. Preliminary data show that last autumn the figure reached about 85 percent (Sadovo I--50 percent). The results of the introduction of the new strains in the country, as well as of their study abroad show the high level reached by our selection work.

Achievements

The averaged data of Bulgarian state strain testing over the past three years covering a large number of foreign and Bulgarian strains indicate that in terms of yields Sadovo I, Levent, Ludogorka, Yubiley, Slavyanka, and Rubin considerably exceed the current standards reached by Avrora and Bezostaya I. Sadovo I is in a leading position. It outstripped Avrora by 100 kg per decare in Northern Bulgaria and by 91 kg per decare in Southern Bulgaria. Last year, in some areas the new low-stem wheats Vega, 3006-44, and 3059-61 yielded high crops as well.

In international experiments along the CEMA line, in 1975 and 1976 Bulgarian wheats assumed either first or a leading position among the best accomplishments of CEMA-member countries. The data of the international testing of our strains, the interest displayed in them, and the considerable quantities of Sadovo I seeds purchased by Hungary, Romania, and other countries lead us to believe that we should think about the more expensive popularization of the achievements of our selection science abroad.

However, Bulgarian wheats are superior to the foreign strains so far widespread in our country not only in terms of high productivity but in a number of other valuable biological and economic qualities. Their shorter vegetation span largely helps to avoid the harmful influence of atmospheric and soil drying and of the dry winds which are a frequent phenomenon in the southeastern part of Europe. Their baking qualities are on the level of the Soviet strains and make possible home bread baking. Ludogorka, Slavyanka, and some other strains have, furthermore, wheat improvement qualities. Their low stems and resistance to falling and crumbling (Sadovo I in particular) make the new strains entirely suitable for high level farming and industrial growing technology. Their good resistance to or tolerance of most diseases of economic importance to the country is yet another of their advantages. Winter and drought resistance as well as good ecological plasticity and adaptability of Bulgarian wheats to the variety of soil and weather conditions in different areas and to meteorological fluctuations in individual years insure a relatively more stable and higher level of yields.

Prerequisites

The good results achieved in wheat selection are no accident. They are due to the following:

specialization and concentration. In 1962 selection work with this crop was focused in three centers: the Wheat and Sunflower Institute in General Toshevo, Tolbutchin Okrug, the K. Malkov Experimental Agricultural Station in Sadovo, Plovdiv Okrug, and the Cotton Institute in Chirpan (for hard wheat);

the national wheat selection program adopted in 1962, and the intensive work developed on its basis in accordance with new contemporary methods. As early as 1962, first in the entire world, we made extensive use in hybridization of the Soviet intensive Bezostaya I strain which, subsequently, became a world standard. This strain participated in the development of all Bulgarian zoned and utilized wheats;

the fast, objective and complete experimental and practical testing of the biological and economic qualities of the latest strains. The most valuable among them were zoned, multiplied, and submitted for production use on an accelerated basis;

we cannot fail to stress as well the visit which Comrade Todor Zhivkov paid the Sadovo Experimental Station in 1965. His valuable instructions on the future development of wheat selection contributed to a decisive upsurge in the work of the entire collective in the field of wheat selection.

The Reflection

In the Sixth Five-Year Plan our wheat production rose 2.5 times compared with 1936-1940; yields rose 3.5 times. Within the same period areas in wheat were reduced by nearly one half. In terms of wheat production

Bulgaria became one of the leading ten grain producing countries in the world. In the first year of the Seventh Five-Year Plan average yields reached 398.3 kg per decare; they exceeded 400 kg in ten okrugs, and reached 450 kg in Ruse and Tolbukhin Okrugs. Thanks to intensification, today we are growing some 300 kg of grain per decare in wheat more than 25-30 years ago. According to most conservative estimates 20-25 percent of this increase is the direct result of the utilization of the new strains. In reality, the increase is bigger, for without the new "intensive" strains we could not have implemented the scientific and technical revolution in wheat growing.

Let us also emphasize that in practice we are still obtaining no more than 55-70 percent of the potential of the used strains. Consequently, at the present stage the strain is not a limiting factor in obtaining considerably higher yields in the Seventh Five-Year Plan. Wheat yield increases are currently limited by the low level of chemization and mechanization factors, power warehousing facilities and post-harvest grain losses.

Wheat selection workers are able to report that they have honorably fulfilled the task set in the speech by Comrade Todor Zhivkov at the 1961 BCP Central Committee Plenum on Agriculture, which called for "accelerating the creation of higher-yielding and better-quality strains matching the new requirements facing our socialist agriculture."

The March Toward 1990

Yet, however pleasing the great current successes may be, they give no reason for complacency. They are consistent with the requirements of today but not for the long term. Rapid measures must be taken to eliminate certain objective and subjective hindrances enabling us to achieve new and even greater successes in wheat selection and utilization, consistent with the Party's order of doubling grain production by 1990. It is imperative as of now to apply in the selection process more advanced work methods, and use better trained cadres and modern equipment. We must also cooperate with the Soviet Union far more closely. It is urgently necessary to build a phytotron. Even though expensive, such a highly effective modern system will accelerate, improve, and facilitate selection work not only with wheat but other crops as well. Unquestionably, the result of its utilization will mark the beginning of new and even greater successes in the development of high yielding and high quality intensive Bulgarian wheat and other crop strains.

What are the strategic directions in selection? The creation of disease-resistant strains using as many resistant sources as possible remains one of the basic. Even though this direction was included in the 1973 selection program, no intensive work was launched in this area. The phytopathologists have not as yet fully entered selection work.

Upgrading the protein content is another strategic direction. Along with increasing the protein in wheat grain particular attention should be paid to work with the new tricale strain obtained as a result of crossing wheat

with rye. This very promising fodder plant contains more protein and lysine than wheat and is less demanding in terms of growing conditions. It is suitable essentially for semi-mountainous areas. In recent years selection work has indeed developed this crop as "the wheat of the future." The yields of developed strains are coming close to even the best wheat strains. These are early-ripening strains with low nonfalling stems and high disease and frost resistance. Last year some tricale strain yields reached 1,160 kg per decare in General Toshevo, 1,100 kg per decare in Sofia, and 800 kg per decare at the Elena APK [Agroindustrial Complex].

As was pointed out at the 1973 Seminar on Wheat Selection held in General Toshevo, a far higher range must be set for the potential grain productivity indicator of 1,600-2,000 kg per decare. The genetic potential of 800-1,000 kg, set in the 1962 program, has already been reached. The science of genetics is opening great prospects for a deeper change in the nature of soft wheat through the development of the type of blade structure which could contain up to 200 grains.

Following Mexican selection, for the past ten years, our selection has followed the trend of developing short-dwarf strains. The initial strains have already been submitted for test strain testing.

The Bulgarian wheat selection workers are aware of their duty and will use their knowledge and creative energy to join actively the nationwide struggle for doubling grain production by 1990.

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CSO: 2202

SEVENTH SYMPOSIUM OF SLOVAK SOCIETY FOR CYBERNETICS AT SLOVAK ACADEMY OF SCIENCES

Prague VESTNIK CSAV in Slovak No 3, 1976 pp 150-152

[Article by Lubomir Cutek]

[Text] The 7th symposium of the Slovak Society of Cybernetics at the Slovak Academy of Sciences was held on 20-22 January 1976. The theme was "On Applications of Theoretical Principles of Cybernetics." The symposium was held at Bratislava on the occasion of the 10th anniversary of the foundation of the Slovak Society for Cybernetics and the 20th anniversary of the foundation of the Institute for Technical Cybernetics at the Slovak Academy of Sciences, which was its co-organizer.

During the 10 years of existence of the Slovak Society for Cybernetics, the symposiums have acquired their tradition and also a very good professional level, and they are the center of great interest on the part of workers from the area of cybernetics all over the CSSR.

Experts from the entire republic attended the symposium. There were altogether 105 participants, including 20 from the Czech Socialist Republic. A total of 62 reports were presented, which were oriented mainly to the area of the theory of management, modeling, and identification, systems programming, control computers of higher generations, and their application in technology and other fields. An almanac of lectures was published on the occasion of the symposium.

The 7th symposium of the Slovak Society for Cybernetics started with a plenary session, at which the participants heard the opening address and three general reports.

The report "Mathematical Theory of Systems -- Myths and Reality" dealt with the problems of the systems theory in relation to the theory of management. It formulated some of the basic problems and opportunities

which can be expected in the future from the systems theory, particularly in the area of composition of systems.

The second general report "Architectures of Parallel Processes of the Fourth Generation Computers" described the present state of affairs in architecture of computer systems, particularly those of higher generations. It also characterized the effects of the technology on the creation of computers and outlined a classification of computer systems according to the types of the arithmetic and logical processors used (serial processor, chain processor, matrix processor, multi-processor), and it characterized briefly individual types of processors.

The last general report "Potential But Not Practically Soluble Algorithmic Problems" discussed the problems of questions which have not been algorithmically solved and their classification, polynomial algorithms considered as equivalents of algorithms applicable in practice, NP -- problems involving questions of optimization and algorithmic problems, for which polynomial algorithms do not exist.

The next session of the symposium was held in four sections and dealt with the following themes:

Section 1 -- problems of identification, modeling, and management of the processes.

Section 2 -- systems programming.

Section 3 -- control computer systems of higher generations.

Section 4 -- application in technology and other fields.

In the first section, there were reports on subjects in the area of information transmission pertaining to problems of transmission of information by complex transmission channels, formal derivation of information systems. In the area of theory of management, there were reports dealing with evolution systems of automated control, adaptive digital regulation of stochastic dynamic systems, solution of Riccati equation, synthesis of single parameter connected control circuits, multiparameter nonlinear digital adaptive regulation circuits, optimal control of systems with extensive parameters, structural decomposition, and methods of coordination of extensive dynamic systems. In the area of identification and modeling, the reports dealt with problems of application of Bashrin algorithms in dealing with nonlinear dynamic systems in a stabilized condition on a digital computer, lack of accuracy of identification assignments, theory of simulation models, final sequential automatic machine as a model of connected dynamic system, and application of physical methods for the purpose of identification of multiparameter systems. In the area of the theory of automatic machines, there was a report pertaining to stochastic automatic machines with changeable structure in nonstationary incidental processes.

In the second section -- Systems Programming --, there were reports which can be divided basically in two groups. In the first group, the reports dealt with problems of parallel programming for computer systems of higher generations by using nonlinear iteration methods, solutions of linear algebraic equations by the chaotic projection method, computation of the determinant of a special category of matrices, computation of the proper numbers of the matrix, solution of a special type of linear equations, computation of fast Fourier transformation, and parallel programming in a system with local memories. In the second group, the reports pertained to the experience gained in the creation of the RPP-Fortran language for the RPP-16 computer; proposal of a programming language, arithmetic expressions of the translating machine of the RPP-Fortran language, disc type translator for the RPP-Fortran language.

The reports in the third section "Control Computer Systems of Higher Generations" dealt with problems of multipurpose computer operating parallelly, programming of specialized processes used for sequence control, algorithms for solution of the problem of coverage by computers, asymptotic complexity of the making of maps of Boole functions, synthesis of multistage logical circuits by means of computer, modeling of the memory system, and generation of biocomputers.

In the fourth section, "Application in Technology and Other Fields," there were reports covering certain areas. In the area of technics, the reports dealt with problems of synthesis of digital high-speed systems used for control of technological processes, by determining the limits of stability of electro-power systems in the area of operational magnitudes, analyses of stability of complex electrification network, adaptive control in case of a distillation column, ASRT of an oxygen convertor, steel works of the VSZ [East Slovakia Ironworks]. In the area of natural sciences, there were reports pertaining to identification of the diffusion coefficient of the hierarchic structure of a mathematical model of management of the system of geosphere and spatial differentiation of the physical-geographic sphere, considered as a large cybernetic system. A number of reports dealt with application of cybernetics in economics and problems of management of socialist economic systems.

The 7th symposium of the Slovak Society of Cybernetics was at a high professional level. The lectures were characterized by search for new modern approaches to the handling of the problems as formulated, and they provided a good survey of the results achieved and of the prospects for handling certain problems, particularly those of technical cybernetics. The symposium was a significant contribution to the exchange of information and to further consolidation of operational contact among experts from the entire republic.

The participants in the symposium consider it to be very appropriate to continue in organizing further symposia of the Slovak Society for Cybernetics, because the society is a forum, where workers from various

scientific fields and disciplines have an opportunity to gain knowledge in the area of application of an interdisciplinary science such as cybernetics. Such assembly of experts contributes very effectively to the application of cybernetic principles in various areas of the life of the Czechoslovak society. This is very important, particularly today, in a period of scientific-technical revolution, which is finding great support among Czechoslovak party and state organs.

5668
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RESEARCH INSTITUTES SEEKING WAYS TO IMPROVE AGRICULTURAL PRODUCTION

Bratislava ROLNICKE NOVINY in Slovak 20 Dec 76 p 5

/Article by Eng Milan Maloch: "What's New in Scientific Institutes?--Practical Findings"/

/Text/ The great importance of genetics--Energy and biological transformers--Automated feed removal systems--Chlorine is a biogenic element.

The foremost specialists in our scientific research institutes study various problems connected with the further large-scale development of agricultural production. It can be said that the results of scientific research and the most efficieny procedures are fast overtaking agricultural practices.

At the Research Institute for Animal Production in Prague-Uhrineves the methods for determining heredity coefficients of agricultural animals were studied. We are currently witnessing an extraordinary expansion of genetics which has become the leading discipline among biological sciences. From the viewpoint of the improvement process in animal husbandry, specifically under conditions of concentrated animal production, the most important is population genetics which studies the processes of heredity and mutation in entire groups of animals, for example, breeds, blood lines or herds. In his study report, Eng Jiri Kolsky from this institute enumerates individual methods for the determination of the heredity coefficient, sets down their mathematical and statistical principles and presents examples which are sufficiently factual for practical application.

To insure further exponential growth of food production in the CSSR the principle of the proposed basic food production concept characterized by the process of transformation of the supplied energy must be mastered. The starting base is finding that plants or agricultural animals act in this process only as biological transformers. The study report on the utilization and transformation of energy in agriculture stresses that in the coming period greater attention will have to be paid also to the utilization of various energy forms such as light, different types of

radiation and air conditioning and to remote control management technology. These energy forms permit the introduction of desirable hygienic and working conditions in agricultural enterprises. The findings answer the need for continuous increase in the quality of work, stresses the author of the study report Eng Antonin Andert, CSc from the Research Institute for Agricultural Technology in Prague-Repy.

Highly topical for securing a high quality feed base in our agricultural enterprises are various feed loading methods from horizontal silos and their evaluation criteria. In the study report on loading devices /vyberace/ which take out silage from horizontal silos, Eng Jiri Vegricht from the VUPT (Food Research Institute) Prague-Repy describes in detail equipment used in loading fodder-manual and attached slicers, unloaders with a rotating or chain cutter, with screw feeder unit, etc. The future development of machines and installations for taking feed out of silage troughs points to automated loading systems. With growing demands for the automation of work operations the use of self-propelled loading machines or of stationary ones connected to the silage trough with hydraulic or electric propulsion will increase.

Only 20 years ago, the discovery was made that chlorine is an indispensable biogenic element in cultivated and wild-growing higher plants. However, its physiological function has not been sufficiently clarified. Eng Josef Silar, CSc from the Institute of Plant Nutrition VURV /Institute for the Research of Vegetable Produce/ Prague-Ruzyne writes in his report about his study of the role of chlorine in the nutrition of agricultural plants that numerous comparative experiments with chloride and sulfate fertilizers yielded differing results with respect to yield, quality and health of the plants. The type of plants and environmental conditions have a contributory effect on yield, the effect of chlorine on quality is mostly detrimental and the same applies to the health of the plants.

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EFFECTIVENESS OF RESEARCH IN THERMOENERGETICS

Bucharest ERA SOCIALISTA in Romanian No 23, Dec 76 pp 41-44

/Article by Eng Teofil Popovici, director of the Research and Planning Institute for Thermal Power Equipment: "Research on Thermoenergetics Judged by the Criteria of Effectiveness"/

/Text/ "Let us make a regular effort toward rapid exploitation of our domestic raw material resources and adoption of the best methods of exploiting them with adequate economic effectiveness." -- Nicolae Ceausescu

The new directives assigned by the Plenum of the Party Central Committee of 2-3 November on the subjects of planning, investments, and technological research and engineering are intended to radically improve our work in the field of scientific and technical development. This calls for the most sparing use of our huge domestic reserves so that science may directly contribute, in accordance with the requirements of our social development, to renovation and modernization of the economic structure, effective use of the raw material and power resources, and improved product performances.

Performance of the particularly important tasks in connection with the rapid development of the sector for manufacturing thermal power equipment requires extensive mobilization of all scientific and technical forces and much higher standards of quality for the new products made, since this sector, although recently developed in Romania, is responsible for supplying on the basis of its own designs the complex equipment with which the national power system will be outfitted in the current five-year plan. We are now proceeding from the experience acquired in the last few years, during which over 20 new types of industrial and power boilers were designed for the big industrial districts as well as a varied assortment of hot water boilers for industry and the housing units, all using low-grade fuels, lignites or bituminous shales. Increasing use of such thermal power installations is permitting natural gases and liquid hydrocarbons to be gradually released from the power sector and more efficiently used for new technological purposes, so that they can be better exploited through chemical treatment. Of course there are inherent technical difficulties in connection with the more productive use of some low-grade solid fuels, handling large masses of fuel and rational use of the resulting ashes, and the

need of precluding new sources of atmospheric pollution. All these points have been intensively studied, leading to adequate technical solutions that are now being applied.

In addition to these studies we should also mention those completed for the assimilation of a wide assortment of standard sizes of steam turbines and turbogenerators for both the big thermoelectric power stations and the heating and power plants, on the premise that simultaneous production of electric power and heat, with distribution of the latter via the heating networks, is one of the best ways of reducing fuel consumption throughout the economy. For instance the new high capacity, 150 megawatt heating unit recently designed and produced in the model stage will permit, once its use is expanded, savings in heat of over 150 gram calories per hour and will save annual imports of about 65,000 tons of fuel oil for every new unit installed in our power system.

This is merely one of the many examples that could be cited of the great possibilities of practical application of innovating thought on the subject of design and production of thermal power equipment.

The party's new directives on scientific research and technological planning and engineering call for better organization and concentration of our entire activity according to the priorities demanded by its continuing comparison with the criteria of maximum effectiveness. For instance one problem of great economic and technical significance with which we are confronted is critical analysis of the past solutions for the industrial structures housing the equipment of the heating and thermoelectric power stations. In view of the nature of this equipment (especially the steam and hot water boilers) the structures designed to cover them entirely have to be tens of meters high. But since the function of these buildings is primarily to shelter service personnel, who work only in a limited area in front of the boiler especially, where most of the measurement and control equipment is concentrated, the specialists of our institute concluded that the designed equipment can be adapted to location outdoors. This enables the designers of power stations to reduce the volume of construction by 30-60 percent, saving hundreds of tons of metal and cement for every boiler. The new construction measures, which are now being finalized, have been analyzed in this respect with the main beneficiaries of thermal power equipment.

But the volume of construction can be greatly reduced not only in the case of stationary equipment like steam boilers but also for such rotary machines as turbines, electric generators etc. Our institute has recently completed the designs for a 60 MVAR /expansion unknown/ synchronous compensator designed to operate outdoors. Although it weighs over 100 tons it requires no building of any kind nor any bridge crane to service it, since the latter's functions are performed by light devices designed along with the main product. We intend to expand such enterprising construction methods by cooperating closely with other institutes organized for construction of heating and power plants and electric power stations.

Reduction of the size and weight of the thermal power equipment itself, while obtaining performances up to world technical standards, is a problem as urgent

as the greatest possible conservation of building materials. Therefore we also try to achieve competitive indices of the quantity of metal used to make our products, to which end our institute considered a number of technical measures to reduce the weight of the equipment. For example, possibilities were found for considerably reducing the weight of the high-capacity boiler designed to supply the major industrial districts, and parameters were attained that even surpass those of the comparable product designed abroad. Application of this experience to other equipment resulted in an extensive program both for the existing installations, wherein considerable savings in metal can be made by redesigning, and for the new equipment included in the institute's research plan, for which our own designs can be extensively promoted and exploited.

Regular emphasis upon these efforts requires good coordination of technological research and engineering, sound knowledge of the technical characteristics of comparable foreign products, and development of the most modern manufacturing methods. Therefore the conception of the activities of scientific research and technological engineering themselves must be based upon the high sense of professional responsibility of the specialist, a specialist of the new type of dedicated revolutionary anxious to boldly apply scientific and technical advances to production.

Rational Use of Secondary Energy Resources

In accordance with the party measures, all programs and plans for scientific research, technological engineering and introduction of technical progress are to be revised and improved for purposes of priority solution of the basic problems of socioeconomic development. In the power field, technological engineering and research are to emphasize development of measures to increase the productivity of the particular installations and equipment and to reduce power losses. In view of the extent of Romania's present power potential, it is clear that even small gains of 0.1-1 percent in the productivity of energy conversion net savings of tens or even hundreds of thousands of conventional fuel. Hence the especially important consequences that can and must be produced by the completed research effort in the field of construction of thermal power equipment.

Our institute, being under an industrial central and supplying designs to big machine building plants (the Bucharest Heavy Machinery Enterprise, the Vulcan Plants, the Cluj-Napoca Small Boilers and Burners Enterprise, and the Bistrita Enterprise for Equipment in the Building Materials Industry), has already made a research and development effort to meet the priority requirements of production. But review of the long-range programs has now led to the future orientation of the studies and technological engineering projects according to criteria of greater effectiveness, while some less important subjects have been abandoned or the research-planning-production cycles have been shortened.

Accordingly, assimilation of new types of boilers using blast furnace gases will make considerable annual savings in superior fuels, while the design and manufacture of a new type of recuperative turbine using low-pressure saturated steam in a ferrous metals combine will result in an additional output of electric power amounting to over 70 million lei. These two examples, besides many others that could be cited, indicate the great possibilities of exploiting the

secondary energy resources in industry. That is why our institute plans to intensify its efforts to design and produce the most diversified energy recovering equipment in order to meet the many requirements of industry. We think recovery and effective use of secondary energy resources constitute a major objective and scientific research and technological development have an important bearing on it. But in addition to painstaking research and engineering operations, the new technologies permitting the use of these secondary resources also require considerable inventiveness to actually produce a useful output with maximum effectiveness.

In this connection it must be borne in mind that any domestic energy resource, however insignificant it may appear at first glance, must be inventoried and then thoroughly analyzed from the technical-economic standpoint in various alternatives, since the maximum effectiveness of its exploitation cannot be determined until the studied alternatives are rationalized.

Despite the good results so far obtained by assimilating boilers recovering the heat contained in blast furnace gases, coke oven gases, and the residual gases from various industrial processes, the great reserves of secondary energy in the industrial districts have been as yet only partially exploited, so that large quantities of thermal energy are being discharged into the air or put to uses far beneath their potentials. Even in the recently constructed units producing electric power or in the thermoelectric power stations for condensation, vast quantities of heat (sometimes hundreds or even thousands of gram calories per hour) are carried off by the cooling waters and are then discharged into the air, at a time when most of the cities and other settlements in the vicinity of these thermoelectric power stations are supplied with heat from independent sources consuming tens of tons of high-grade fuel every hour to produce thermal energy.

The present consumption of thermal energy for heating in some cities could be reduced by as much as 70-80 percent by locating the consumers of thermal energy closer to the sources of electric power production and also by supplementing some equipment and modifying the existing equipment, which operations can be planned and implemented by our planning institutes and those for technological engineering and research. Furthermore, once the production of electric power and thermal energy is centralized and heat is distributed via the heating networks, a number of small and uneconomic heating plants that are consuming high-grade fuels while they pollute the environment will disappear.

Generally speaking, when it is intended to make more effective use of the secondary energy resources in a given industrial district, the principle that these resources are to be exploited solely within the district in question is often observed. But this principle is not always applicable to the economic conditions, and we think it would be advisable to consider the exploitation of all secondary energy resources in the light of any possible uses of the thermal energy by other consumers in the vicinity. For example, the residual heat from the big industrial districts could be used to heat the industrial premises or residential districts in the neighboring areas to particular advantage from the standpoint of fuel conservation.

Development of Industrial Production Within the Institute

An essential problem in machine building today is that of further concentrating the internal designing effort on redesign and standardization of the products, to eliminate overproportioning and provide for short cycle manufacturing by reusing as many components and subassemblies as possible when one product is replaced by another within the chosen assortment of standard sizes. This organization of designing work has produced particularly good results in planning the products, since it considerably reduces the workload. But it is especially effective in production because in addition to reducing the costs for assimilating the new products it also considerably curtails the manufacturing cycle, the volume of handling and consequently the operating costs. For example, thanks to an extensive standardization program for the construction of the new types of power turbine units, the latter have been about 70 percent standardized in the range of 3-12 megawatt capacities. This means that if one type of turbine unit is replaced by another, within this standardized range, it will cost only 30 percent as much to assimilate the new components or subassemblies as it would to assimilate all of them. This method must be generalized in planning all assortments of standardized sizes of heat and power units.

But the very complexity of all the heat and power installations and equipment that go to make up an electric power station makes it necessary to provide the basic equipment (boilers, turbines and generators) with a number of additional elements for measurement, control, protection and surveillance. While the basic equipment is manufactured by the heavy machine building industry, the additional elements are manufactured by the electrotechnical and precision machinery industries if they are ordered in large series or they are imported in the case of small series.

A considerable outlay of foreign exchange is required to import these small series elements because they are produced in small series in other countries too. It should also be noted that 1 kg of such products costs 1,00-?,000 lei, as contrasted with 40-150 lei for 1 kg of metal incorporated in basic equipment such as boilers, turbines etc. Hence the great importance of organizing production sections to assimilate and provide industry with the highly sophisticated additional elements within the institutes for technological development and research.

In the last few years our institute has assimilated dozens of such products which we are manufacturing and delivering to domestic beneficiaries. But the assimilation of these products to avoid expensive imports presents another problem, namely that of the limited output of the research and planning institutes which cannot meet the growing demands of the economy. As a matter of fact some of the highly sophisticated additional elements are still being imported in spite of all the efforts we have made, so that every research and planning institute must make a consistent effort to develop its own production base in addition to its efforts to design and assimilate new additional elements.

Besides its favorable economic effect upon the balance of foreign trade, the development of internal production in institutes fosters a climate of sustained activity in a complete research-planning-production cycle with rapid completion

and maximum effectiveness. In view of these considerations we are now trying to develop our base of industrial production in the institute on a far broader scale. Based upon highly effective investments, this production will soon be comparable to that of a small industrial enterprise.

Of course these new objectives which we have been discussing and toward which our specialists' entire technological engineering and research effort is directed must be very resolutely pursued, which is why we think all the efforts to be made must be supported by intensive political indoctrination to mobilize and encourage the researchers, planners and engineers to promote innovation, worthy initiatives and original scientific creation manifested in specific products with operational parameters meeting worldwide standards.

Measures with specific deadlines and responsibilities have been planned on the basis of thorough analyses made in our institute. The planned measures will ultimately lead to:

- Review of the measures for partial installment of boiler units in the heating plants and thermoelectric power stations outdoors, which will reduce metal consumption by 4,000-5,000 tons a year and considerably reduce the consumption of cement and other building materials;

- Reduction of the metal inputs in a number of steam boilers through review of the construction methods, making annual savings of about 2,000 tons of steel, which savings will be reflected in the output of the supplier plants;

- Savings in traditional fuel through recovery of blast furnace gases and use of the latter in the furnaces of the two boilers with capacities of 210 tons per hour that will be installed in the Calarasi Ferrous Metals Combine, thus releasing about 200,000 tons of conventional fuel a year;

- Use of low-grade lignite fuel for the boilers with capacities of 525 tons per hour for the new district heating plants, thus avoiding annual imports of 200,000 tons of fuel oil for each newly installed boiler.

We are sure that these measures will considerably improve the products designed and produced by our institute in accordance with the new directives and tasks the party has assigned.

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